

## **Seafloor Shear Measurement Using Interface Waves**

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### **LONG-TERM GOALS**

The long term goal of our research is to improve the estimation of bottom properties by understanding and incorporating the effects produced by shear.

### **OBJECTIVES**

The objectives of this proposal are to:

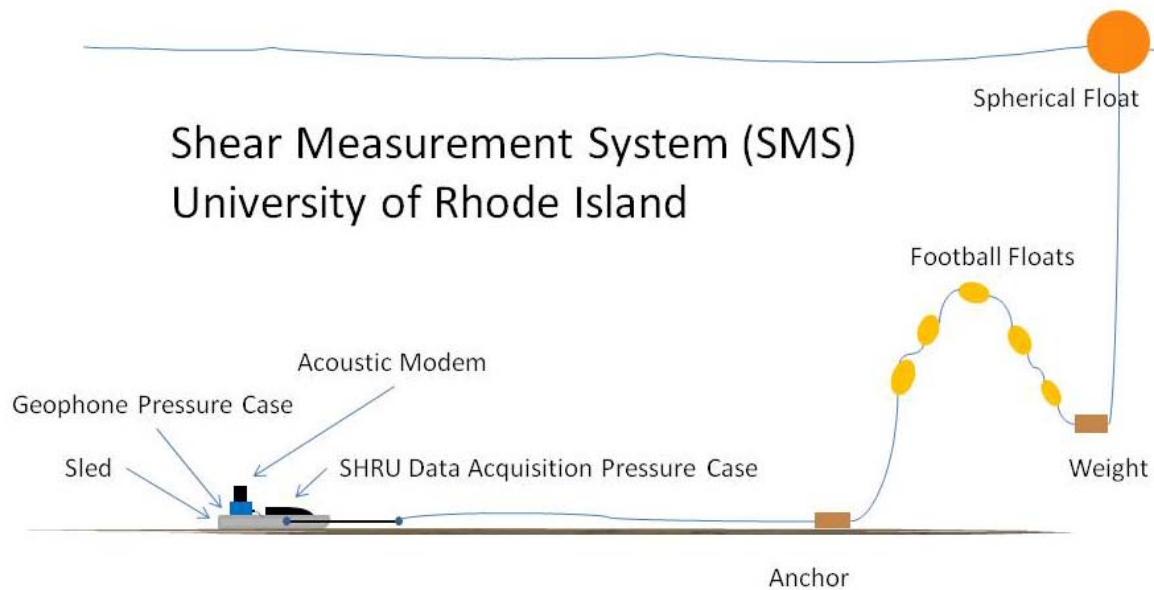
- Develop an acoustic/seismic receive system for the estimation of sediment compressional wave speed, compressional wave attenuation and shear wave speed.
- Develop new inversion techniques for shear properties: A new inversion scheme is being developed to estimate shear properties of the sediment using interface wave dispersion.

### **APPROACH**

Figure 1 shows the conceptual schematic of the system. This shear measurement system consists of the following components:

1. Sled: The sled houses the data acquisition system. The sled will be connected to a tow cable with appropriate chain and floatation to isolate the wave motion from the geophone/ hydrophone receive array. The termination of the tow cable at the surface will consist of a float and appropriate mechanical connectors to deploy, move, leave, and recover the system.
2. Acquisition System: Two Several Hydrophone Receive Systems (SHRUs) serve as the data collection system.
3. Receive array: The receive array consists of gimbaled geophones and hydrophones.

| Report Documentation Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                     |                                                           | Form Approved<br>OMB No. 0704-0188                  |                                 |
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*Figure 1. Shear measurement system consisting of a geophone/hydrophone array and data collection system (SHRU)*

## WORK COMPLETED

All the components of the shear measurement system have been acquired. The SHRUs were built at WHOI and have been delivered to URI. The geophones and hydrophones have been successfully connected to the SHRUs and the system has been bench tested. Figure 2 shows the pictures of the SHRU data acquisition systems and the geophone array. We are planning to conduct tests on land and at a test facility shortly. A joint test with ARL-UT (Preston Wilson, PI) using their Combustive sound source is also planned. of our graduate student, Jeannette Greene, has been involved in the design and testing of this system including the sled which will house the data collection system.



*Figure 2. Left panel shows the two SHRU data collection systems. Right panel shows the geophone array consisting of gimbaled geophones.*

## **RESULTS**

We have acquired a geophone/hydrophone array capable of collecting interface wave data. Using the dispersion characteristics of the interface wave data we propose to invert for shear wave speed. A mobile version of the CSS could be used to generate the interface waves. The array consists of two Several Hydrophone Receive Units (SHRUs) built by WHOI each having 4 channels. An array consisting of geophones and hydrophones will be mated to this data collection system. Tests are planned in the near future using the Combustive Sound Source (CSS) developed at ARL-UT (Preston Wilson). One of our graduate students, Jeannette Greene, has been involved in the design and testing of this system including the sled which will house the data collection system.

## **IMPACT/APPLICATIONS**

The inversion scheme using interface waves is suitable for estimation of acoustic properties of sediments in shallow water. Our receive system can be easily deployed at multiple locations. Using multiple deployment of the receiver, sediment properties can be estimated along various tracks which would allow an area to be mapped. This new system and the estimation of shear speed compliments our long range sediment tomography technique, which estimates compressional wave speed and attenuation.

## **TRANSITIONS**

The sediment parameters obtained by this inversion will compliment the forward modeling efforts. The sediment tomography technique is suitable for forward force deployment when rapid assessment of environmental characteristics is necessary.

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1. Gopu R. Potty and James H. Miller, "Time-frequency analysis techniques for long range sediment tomography," J. Acoust. Soc. Am. 126 2207 (2009).
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11. Gopu R. Potty, James H. Miller," Studies on the effect of shear on compressional wave attenuation," European Conference on Underwater Acoustics (ECUA 2010), Istanbul, Turkey, 5-9 July, 2010.

## **HONORS/ AWARDS/ PRIZES**

James Miller and Gopu Potty participated in the First INDO – US Workshop on Shallow Water Acoustics, National Institute of Oceanography, Goa, India, February 3 - 4, 2010.

James H. Miller and Gopu Potty visited Indian Institute of Technology, Delhi and James Miller gave a talk titled “Intensity fluctuations of acoustic transmissions due to internal waves in shallow water” February, 01, 2010.

Gopu Potty visited Indian Institute of Technology, Chennai and gave a talk titled “Recent Trends in Ocean Acoustics Research ” May, 11, 2010.

Gopu Potty was nominated to the Advisory Committee and Technical Program Committee of the International Symposium on Ocean Electronics organized by the Cochin University of Science and Technology in Cochin, India (November, 2010).